

REMARKS

Claims 1-22 are pending in the application; the status of the claims is as follows:

Claims 4-7, 11-14, 16, and 19-22 are presently withdrawn from consideration as being directed to the non-elected species. (However, it is acknowledged that Claim 17 is generic.);

Claims 1, 3, 8, 10, 15, 17, and 18 are rejected under 35 U.S.C. § 102(b) as being anticipated by Uchiya, JP(A) 8-330557;

Claims 1-3, 8-10, 15, 17, and 18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hokari, U.S. Patent No. 5,654,565, in view of Nishioka, U.S. Patent No. 5,121,213.

By this amendment, claims 1, 8, 15 and 17 have been amended to expressly recite an optical relationship between the diaphragm (or light controlling means) and the light receiving portions of the image sensor.

35 U.S.C. § 102(b) Rejection

The rejection of claims 1, 3, 8, 10, 15, 17, and 18 under 35 U.S.C. § 102(b) as being anticipated by Uchiya, is respectfully traversed based on the following.

Claim 1 as now presented, recites:

An image pickup device comprising:
 an image sensor having rectangular light receiving portions arranged in a matrix, and microlenses disposed in correspondence with said light receiving portions, said light receiving portions and said microlenses being formed integrally with each other; and
 an image input optical system for forming an image on said image sensor, said image input optical system including a diaphragm;
 wherein the diaphragm has a shape in a vertical direction that coincides with a shape of said light receiving portions of said image sensor, said diaphragm restricting light along a horizontal direction to prevent the light from being incident outside the light receiving portions of the image

sensor, and said diaphragm and the light receiving portions of said image sensor are in a conjugate relationship. (Emphasis Added.)

Thus, the apparatus of claim 1 is an “image pickup device” which includes at least two major components:

- (1) an image sensor, and
- (2) an image input optical system.

In claim 1, the image sensor is made up of several components, including microlenses. Significantly, the image input optical system is recited in the claim as a separate component from the image sensor. Claim 1 also recites that the image input optical system is for forming an image on the image sensor. Significantly, the image input optical system is the system that includes a diaphragm – not the image sensor. Finally, claim 1 also requires that the diaphragm and the light receiving portions of said image sensor are in an optical conjugate relationship with each other.

As explained in the following, Uchiya fails to disclose the invention of claim 1.

Uchiya discloses an image sensor which is made up of, *inter alia*, micro lenses and a light-shielding film 12. Uchiya, however, fails to disclose an image input optical system, much less an image input optical system which includes a diaphragm according to the requirements of claim 1. In Uchiya, the light shielding film is a layer that is part of the image sensor.

Although claims are given the broadest reasonable interpretation during prosecution, such interpretation “must also be consistent with the interpretation that those skilled in the art would reach.” MPEP §2111 (Rev. 2, May 2004, page 2100-47).

The comparison of Uchiya to claim 1, as set forth in the present office action, contorts Uchiya in a way which is inconsistent with how that reference would be viewed by one of ordinary skill in the art and inconsistent with how the present invention would

be viewed by one of ordinary skill in the art. In fact, the plain language of claim 1, and the description of the preferred embodiments of the present invention, reveals that Uchiya does not apply.

Claim 1 requires that the diaphragm be “included” within the image input optical system and that that optical system “form[] an image on the image sensor.” However, to attempt to stretch Uchiya to attempt to fit it to the invention of claim 1, the requirements of claim 1 must be ignored. In the office action, the examiner has alleged that the image input optical system comprises parts of the image sensor. Such a reading is inconsistent with how that reference would be viewed by one of ordinary skill in the art. Regardless of whether components of the image sensor have optical properties and regardless of whether such components are involved in the propagation of light to the active areas of the sensor, these components of the sensor would simply not be regarded as an “image input optical system” “which forms an image on the sensor.” Specifically, the image sensor does not form an image on itself. Instead, an external optical system separate from the image sensor the forms an image on the image sensor. Finally, claim 1 requires that the diaphragm and the light receiving portions of the image sensor be in a conjugate relationship. Thus, even if the shielding film 12 of Uchiya can be equated to the present diaphragm, Uchiya also fails to disclose this optical relationship.

The application of Uchiya to claim 1 is also inconsistent with the disclosure and acknowledgements of the present invention. Specifically, the examiner has equated the shielding film 12 of Uchiya to the Diaphragm of claim 1. However, the current specification and drawings acknowledge that image sensors may have shielding films as a layer *within* the image sensor. For example such layer is described and illustrated in the present specification at page 5, lines 2-3 and Fig. 11, layer 7. The concepts disclosed in the present specification, and the invention claimed in claim 1, is not the sensor shielding film 7. Moreover, the language of claim 1 is not ambiguous so as to permit such a reading. Instead, precisely as claimed, the invention of claim 1 comprises an image

pickup device made up of both (1) an image sensor and (2) an image input optical system, where the input optical system includes a specific diaphragm.

For the foregoing reasons, Uchiya fails to disclose each element of claim 1 and thus is unable to anticipate this claim, or claim 3 which depends therefrom.

Claim 8 is directed to an “image input optical system.” This optical system is claimed as being “for forming an image on an image sensor” (having certain characteristics). Thus, similar to claim 1, claim 8 unmistakably separates the “image input optical system” from the “image sensor.” Again, like claim 1, it is the “image input optical system” that includes the diaphragm so that such diaphragm can affect the light before the light is incident on the image sensor. Again, similar to claim 1, claim 8 requires that the diaphragm be positioned so that said diaphragm and light receiving portions of the image sensor, positioned with respect to said image input optical system to have an image formed thereon, are in a conjugate relationship.

As discussed above, Uchiya fails to disclose an image input optical system, much less an image input optical system which includes a diaphragm according to the requirements of claim 8. Instead, in Uchiya, the light shielding film is a layer that is part of the image sensor. For this reason, Uchiya fails to disclose each element of claim 8 and thus is unable to anticipate this claim, or claim 10 which depends therefrom.

Claim 15, similar to claim 1, comprises both an “image input optical system” and an “image sensor.” The image input optical system and the image sensor are recited as separate components. Again, similar to claim 1, it is the “image input optical system” that includes the diaphragm so that such diaphragm can affect the light before the light is incident on the image sensor. Again, similar to claim 1, claim 15 requires a conjugate relationship between the diaphragm and the light receiving portions of the image sensor. Such a structure is inconsistent with the reading of Uchiya used to articulate the present rejection.

As discussed above, Uchiya fails to disclose an image input optical system, much less an image input optical system which includes a diaphragm according to the requirements of claim 15. Instead, in Uchiya, the light shielding film is a layer that is part of the image sensor. For this reason, Uchiya fails to disclose each element of claim 15.

Claim 17, similar to claims 1 and 15, comprises both an “image input optical system” and an “image sensor.” The image input optical system and the image sensor are recited as separate components. Again, similar to claim 1, the “image input optical system” includes a “light controlling means” so that such means can affect the light before the light is incident on the image sensor. Again, similar to claim 1, claim 17 requires a conjugate relationship between the light controlling means and the light receiving portions of the image sensor. Such a structure is inconsistent with the reading of Uchiya used to articulate the present rejection.

Instead, as discussed above, Uchiya fails to disclose an image input optical system, much less an image input optical system which includes a light controlling means according to the requirements of claim 17. Instead, in Uchiya, the light shielding film is a layer that is part of the image sensor. For this reason, Uchiya fails to disclose each element of claim 17 and thus is unable to anticipate this claim, or claim 18 which depends therefrom.

Accordingly, because Uchiya does not disclose the invention claimed in any of the foregoing claims, it is respectfully requested that the rejection of claims 1, 3, 8, 10, 15, 17, and 18 under 35 U.S.C. § 102(b), as being anticipated by Uchiya, be reconsidered and withdrawn.

35 U.S.C. § 103(a) Rejection

The rejection of claims 1-3, 8-10, 15, 17, and 18 under 35 U.S.C. § 103(a), as being unpatentable over Hokari in view of Nishioka, is respectfully traversed based on the following.

Claim 1 as now presented, recites:

An image pickup device comprising:

...

an image input optical system for forming an image on said image sensor, said image input optical system including a diaphragm;

wherein the diaphragm has a shape in a vertical direction that coincides with a shape of said light receiving portions of said image sensor, said diaphragm restricting light along a horizontal direction to prevent the light from being incident outside the light receiving portions of the image sensor, and said diaphragm and the light receiving portions of said image sensor are in a conjugate relationship. (Emphasis Added.)

Thus, the apparatus of claim 1 is an "image pickup device" which includes at least two major components: an image sensor, and an image input optical system.

Significantly, the diaphragm has specific characteristics:

- (1) it has a shape in a vertical direction that coincides with a shape of said light receiving portions of said image sensor,
- (2) the diaphragm is configured so as to restrict light along a horizontal direction to prevent the light from being incident outside the light receiving portions of the image sensor, and
- (3) the diaphragm and the light receiving portions of the image sensor are in a conjugate relationship

As discussed in the following, Hokari and Nishioka, singly or in combination, fail to disclose, suggest or teach the invention of claim 1.

The present office action acknowledges that Hokari fails to disclose an image input optical system including a diaphragm according to the requirements of claim 1. Nishioka does not disclose a diaphragm which is configured so as to restrict light along a horizontal direction to prevent the light from being incident outside the light receiving portions of the image sensor. In fact, Nishioka expressly teaches away from the present invention.

A primary aspect of Nishioka is a structure which avoids aliasing (i.e., moiré effect) without requiring the cost and complexity of a conventional low band pass filter. Each embodiment of Nishioka (i.e., multiple curved surface, polyhedral surface, symmetric cylindrical surface, etc.,) is configured to lengthen the “contour of an image of the exit end face of an illuminating optical system . . . parallel to a scanning direction” without the use of the optical low-pass filter (col. 1, line 56 – col. 2, line 5).

In other words, Nishioka teaches spreading the light which may normally be incident on a single pixel of the sensor across more than one pixel. The light is purposefully blurred (spatial resolution reduced) parallel to the scanning direction. This objective and teaching of Nishioka is directly opposite to the objective and claims of the present application. In short the claims of the present invention are directed to an image pickup device and image input optical system that attempts to prevent light intended for one pixel from spilling outside that pixel. I.e., claim 1 requires, inter alia, that the diaphragm “restrict[] light along a horizontal direction to prevent the light from being incident outside the light receiving portions of the image sensor.” Nishioka, in contrast, purposefully spreads light intended for one pixel across more than one pixel. Thus, Nishioka teaches away from the present invention.

The passages from Nishioka cited by the examiner are noted. However, as explained below, this disclosure does not disclose or suggest the invention of claim 1. Specifically, Nishioka states that the stop “is configured not in a circle, but in lateral extension such as an ellipse (solid line) and a rectangle (dotted line), along the scanning direction 24 of the solid-state image sensor 19.” (col. 8, lines 41-46) As is evident from that disclosure, Fig. 25B, and the specification of Nishioka, by extending the width over which the light is spread, the ellipse allows the light to blur, acting like a low pass filter and thereby reducing aliasing or moiré effect. Thus, consistent with the rest of the disclosure of Nishioka, this disclosure by Nishioka is precisely opposite to the requirements of claim 1. As noted above, blurring the light and functioning like a low

pass filter as disclosed by Nishioka, teaches away from the principles of the claimed invention.

It is also noted that the examiner points to the statement in Nishioka that “[o]therwise, if the stop is formed substantially in the shape as one pixel element of the solid-state image sensor, a depth of field is advantageously obtained to be most sufficient.” (col 8, lines 51-54) This statement also fails to disclose or suggest the invention of claim 1 and is, at best, ambiguous.

Claim 1 requires that the diaphragm “prevent the light from being incident outside the light receiving portions of the image sensor.” This effect does not automatically follow from a stop which affects depth of field.

As is known in optics, a smaller aperture (higher f-number optical system) has a greater depth of field than a larger aperture (low f-number optical system), all other things equal. At large apertures (low f-number) image forming light converges obliquely on the image plane. In that situation, if a focused object is moved nearer or farther from the image optical system, the focus point is displaced from the image plane to a point in front of it or behind it. The magnitude of defocusing depends on the breadth of the cone of light projected from the rear lens element and truncated by the image plane. A smaller aperture, in contrast, restricts low f-number rays (far off axis rays), allowing the rays incident on the image plane to more closely approximate parallel rays. A narrow cone spreads the image less for a given object displacement than a wide cone. As a result, the higher f-number optical system yields a more in focus image for objects located in front of and behind the point of focus.

None of this, however, has anything to do with the invention of claim 1. The disclosure of col. 8, lines 41-46 (elliptical stop) and the disclosure of lines 51-54 (stop in the same shape as one pixel element) are plainly set forth in Nishioka in the form of a comparison. In essence, the disclosure teaches that one can either use the elongated

elliptical stop, so that false color can be decreased; “otherwise” one can use a stop shaped like the pixel, to obtain advantageous depth of field.

Neither of these alternatives, however, discloses, or suggests that a diaphragm be sized, located or configured so as to “prevent the light from being incident outside the light receiving portions of the image sensor.” In fact, in trying to combine Nishioka and Hokari, the present office action says that the “lateral extension of the stop would be oriented in the vertical direct of Hokari’s image sensor . . . and . . . would restrict light along a horizontal direction.” Here the examiner has improperly modified the cited references, using the teachings of the present invention as a roadmap, in order to attempt to articulate an obviousness rejection. This combination fails because, inter alia, the examiner has changed the principle of operation of the stop in creating the modification (by requiring that it be rotated). This combination also fails because the motivation to rotate the stop comes solely from the present disclosure. For these reasons, the combination of Hokari and Nishioka fails to render obvious the invention of claim 1, or claims 2 and 3, which depend therefrom.

As noted above, Claim 8 is directed to an “image input optical system.” This optical system is claimed as being “for forming an image on an image sensor” (having certain characteristics). Again, like claim 1, it is the “image input optical system” that includes the diaphragm which “restrict[s] light along a horizontal direction to prevent the light from being incident outside the light receiving portions of the image sensor.”

As discussed above, the combination of Hokari and Nishioka fails to disclose an image input optical system which includes a diaphragm according to the requirements of claim 8. Instead, Nishioka teaches away from the present invention by suggesting that spatial resolution be degraded to avoid aliasing and moiré. For this reason, Hokari and Nishioka fail to render obvious claim 8, or claims 9 and 10 which depend therefrom.

Claim 15, similar to claim 1, comprises both an “image input optical system” and an “image sensor.” The image input optical system and the image sensor are recited as

separate components. Again, similar to claim 1, it is the “image input optical system” that includes the diaphragm so that such diaphragm can affect the light before the light is incident on the image sensor.

Hokari and Nishioka fail to disclose an image input optical system which includes a diaphragm according to the requirements of claim 15. Instead, Nishioka teaches that spatial resolution should be degraded to avoid aliasing and moiré. For this reason, Hokari and Nishioka fail to render obvious claim 15.

Finally, Claim 17 is similar to claims 1 and 15 in that it comprises both an “image input optical system” and an “image sensor.” Again, similar to like claim 1, the “image input optical system” includes a “light controlling means.” Moreover, claim 17 requires that the “light controlling means restrict[s] light along a horizontal direction to prevent the light from being incident outside the light receiving portions of the image sensor.”

Instead, as discussed above, Hokari and Nishioka fail to disclose an image input optical system which includes a diaphragm according to the requirements of claim 17. Instead, Nishioka teaches that spatial resolution should be degraded to avoid aliasing and moiré. For this reason, Hokari and Nishioka fail to render obvious claim 17, or claim 18 which depends therefrom.

Accordingly, it is respectfully requested that the rejection of claims 1-3, 8-10, 15, 17, and 18 under 35 U.S.C. § 103(a) as being unpatentable over Hokari in view of Nishioka, be reconsidered and withdrawn.

In view of the foregoing remarks and Amendments, this application is considered to be in condition for allowance, and an early reconsideration and a Notice of Allowance are respectfully requested.

This Amendment does not increase the number of independent claims, increases the total number of claims by 2 from 22 to 24, and does not present any multiple

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dependency claims. Accordingly, a Response Transmittal and Fee Authorization form authorizing the amount of \$100.00 to be charged to Sidley Austin Brown & Wood LLP's Deposit Account No. 18-1260 is enclosed herewith in duplicate. However, if the Response Transmittal and Fee Authorization form is missing, insufficient, or otherwise inadequate, or if a fee, other than the issue fee, is required during the pendency of this application, please charge such fee to Sidley Austin Brown & Wood LLP's Deposit Account No. 18-1260.

If an extension of time is required to enable this document to be timely filed and there is no separate Petition for Extension of Time filed herewith, this document is to be construed as also constituting a Petition for Extension of Time Under 37 C.F.R. § 1.136(a) for a period of time sufficient to enable this document to be timely filed.

Any other fee required for such Petition for Extension of Time and any other fee required by this document pursuant to 37 C.F.R. §§ 1.16 and 1.17, other than the issue fee, and not submitted herewith should be charged to Sidley Austin Brown & Wood LLP's Deposit Account No. 18-1260. Any refund should be credited to the same account.

Respectfully submitted,

By: _____


Thomas N. Tarnay
Registration No. 41,341
Attorney for Applicant

TNT/llb:br
SIDLEY AUSTIN BROWN & WOOD LLP
717 N. Harwood, Suite 3400
Dallas, Texas 75201
Direct: (214) 981-3388
Main: (214) 981-3300
Facsimile: (214) 981-3400
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